

has wide acceptance among the mobile radio community and represents a conservative estimate of the interfering power with respect to free space loss.

The formulas in ITU-R Recommendation P.529-2 provide an estimate of signal strength as a function of distance assuming a transmitter Equivalent Radiated Power of 1 kilowatt. A formula is given in ITU-R Recommendation P.1146 to convert the estimated value of signal strength into transmission loss. The composite formula used to produce the accompanying curves is:

$$L_b = 199 + 20\log(f/1000) - 65.55 + 6.16\log(f) + 13.82\log(h_1)$$

$$-a(h_2) - (44.9 - 6.55\log(h_1))\log(R^b)$$

where:  $a(h_2) = (1.1\log(f) - 0.7)h_2 - (1.56\log(f) - 0.8)$

$f$  is the frequency in MHz,

$h_1$  is the height of the transmitter antenna,

$h_2$  is the height of the receiving antenna,

$R$  is the range in meters,

$b=1$  for  $R < 20$  kilometers.

Two curves are shown in the accompanying Figure. The upper curve shows the Received Signal Level (RSL) in dBm, at a Globalstar user terminal, for an RF lighting device with a microwave power output of 15 watts. These points are labeled "RSL FUS(dBm)." The lower curve shows the RSL at a Globalstar user terminal assuming that the RF lighting device had an output power equivalent to a microwave oven operating continuously indoors and in compliance with the radiation guidelines of the U.S. Food and Drug Administration of 5 milliwatts per square centimeter, 5 centimeters from the oven. These points are labeled "RSL MWO(dBm)." One notes that the RSL at the Globalstar user terminal is consistently 25.8 dB lower for the equivalent microwave oven than for the RF lighting device. In the Addendum to The Mobile Satellite Service (MSS) Above 1 GHz Negotiated Rulemaking Committee Report (April 6, 1993), dealing with Sharing with Services Other than ARNS and RAS, it was indicated that a building shielding loss, that is effectively the difference between continuously operating microwave oven indoors or outdoors, of 16 dB was suitable when determining the potential interference to the Mobile Satellite Service. This 16 dB loss has been included in the calculation of the lower curve. An additional factor that has not been included in the lower curve in the accompanying Figure is the equivalent loss due to the microwave oven activity. Microwave ovens unlike microwave lighting

devices are not on all of the time. Thus, an additional loss is necessary so that RF lighting devices mounted in elevated locations and operating continuously for long periods of time would present an interference threat similar to microwave ovens that were considered during the MSS Above 1 GHz Negotiated Rulemaking. At this point in time, it is not possible to give an estimate of the loss that would be equivalent to an intermittently operating microwave oven and, therefore, it is not included in this analysis.

In the Technical Appendix to the Comments of Loral/Qualcomm Partnership to the Big LEO proceeding, it is indicated that interference at a Receive Signal Level of -90 dBm would produce call failure and a Receive Signal Level of -95 dBm would cause aural signal degradation. User terminals in the Globalstar system are designed to operate outdoors as fixed, handheld or vehicular mounted devices. The accompanying Figure demonstrates that there would be a strong possibility that a Globalstar user terminal would experience call disruption within 500 meters from the current Fusion Lighting RF Lamp or would experience aural signal quality degradation within 600 meters. The lower curve in the accompanying Figure indicates that if the RF lighting device had an output power equivalent to a household microwave oven operating continuously indoors, the Globalstar user terminal could be within 200 meters of the RF lighting device and still operate successfully. The inclusion of a suitable additional loss reflecting the microwave oven activity factor in the analysis would indicate that the Globalstar user terminal could be closer to an RF lighting device and still operate successfully. This additional loss is yet to be determined.

6. The International Telecommunications Union (ITU) considers interference that produces an increase in receiver noise level of 6% to be a trigger for coordination between the interfering party and the interfered with party. This is equivalent to an interfering signal 12 dB below the noise level of the Globalstar user terminal receiver. The Globalstar user terminal receiver noise level is -112 dBm thus interference corresponding to the coordination trigger level would be -124 dBm. From the accompanying Figure it is apparent that a Globalstar user terminal would have to be at least 4 kilometers from a Fusion RF lighting device in order for the interference to be below the ITU coordination trigger level.

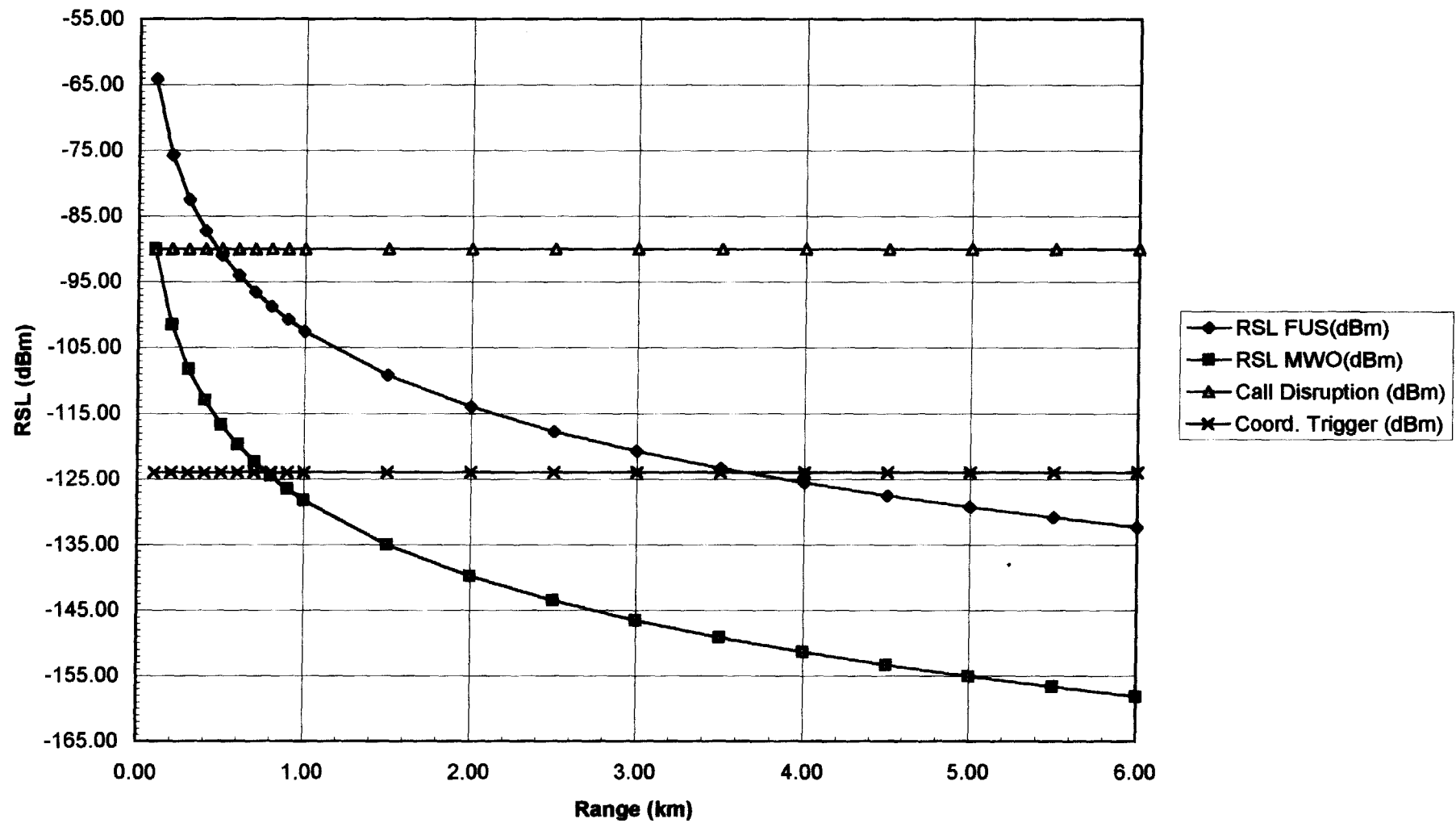
7. A Field Strength Limit of 100 microvolts per meter is proposed in the instant NPRM for radiated emissions from RF lighting devices outside of the band 2450+/- 50 MHz. The imposition of this limit in the 2483.5 - 2500 MHz band which is allocated to the Mobile Satellite Service would provide protection for Globalstar user terminals that would be exposed to radiation from microwave lighting devices. If a microwave lighting device met the 100 microvolt per meter limit, the microwave emissions would correspond to those coming from an isotropic source of 0.3 microwatts (-35.2 dBm). Assuming free space propagation loss, a Globalstar user terminal would have to be less than 6 meters from the lighting device before calls

would be interrupted. If a Globalstar user terminal operated 36 meters or more from a microwave lighting device meeting the 100 microvolt per meter limit, the lighting device radiation would be below the ITU interference coordination limit of -124 dBm, assuming that the Hata propagation model applied. A radiated field strength limit applied over the 2483.5-2500 MHz band is thus needed to provide protection to Globalstar user terminals.

8. It is well to keep in mind that the purpose of RF lighting devices is illumination and not the production of energy outside of the visual spectrum. The Federal Communications Commission has long promoted, if not demanded, that all devices emitting radio frequency energy be designed and constructed utilizing *good engineering practice* (CFR47 § 18.109), regardless of whether the device is licensed or unlicensed. Good engineering practice for RF lighting devices would be maximizing the energy emitted in the visual spectrum and minimizing the emissions at all other frequencies.

Microwave energy and light are both forms of electromagnetic radiation. The microwave energy is centered around a frequency of 2450 MHz while the light energy is centered around a frequency of 571 Terahertz (THz). Given the vast difference in frequency, more than five decades, it appears that it should be possible to design and implement a high pass filter, that could be used at the output of the RF lighting device, that would pass the visual light and reject the microwave energy thus reducing the microwave energy output of the RF lighting device to acceptable levels.

# Received Signal Level at Globalstar Terminal for RF Lighting Devices and Equivalent Microwave Ovens



DECLARATION

1. I, David E. Weinreich, am the Spectrum Manager for Globalstar.
2. I am familiar with the original Globalstar™ application filed with the Federal Communications Commission on June 3, 1991, and the amendments to this application filed on November 16, 1994, and March 8, 1996 and with the comments filed by Globalstar in the "Big LEO" Rulemaking. I am familiar with Parts 18 and 25 of the Commission's Rules and the rules and policies proposed for the Fusion RF lighting devices in the Notice of Proposed Rulemaking released April 9, 1998.
3. I have prepared the foregoing "Technical Comments" and the information presented therein and the technical information in the accompanying Reply Comments is accurate.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Signed this 24<sup>th</sup> day of August 1998 in Washington,  
D.C..



David E. Weinreich  
Spectrum Manager  
Globalstar, L.P.

## **CERTIFICATE OF SERVICE**

I, William D. Wallace, hereby certify that I have on this 24th day of August, 1998, caused true and correct copies of the foregoing "Joint Reply Comments" to be served via hand delivery upon:

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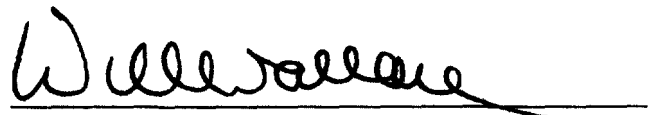
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